New Jersey Department of Transportation
Office of Maritime Resources

Beneficial Use of Dredged Material: Three Decades of Experience in New Jersey

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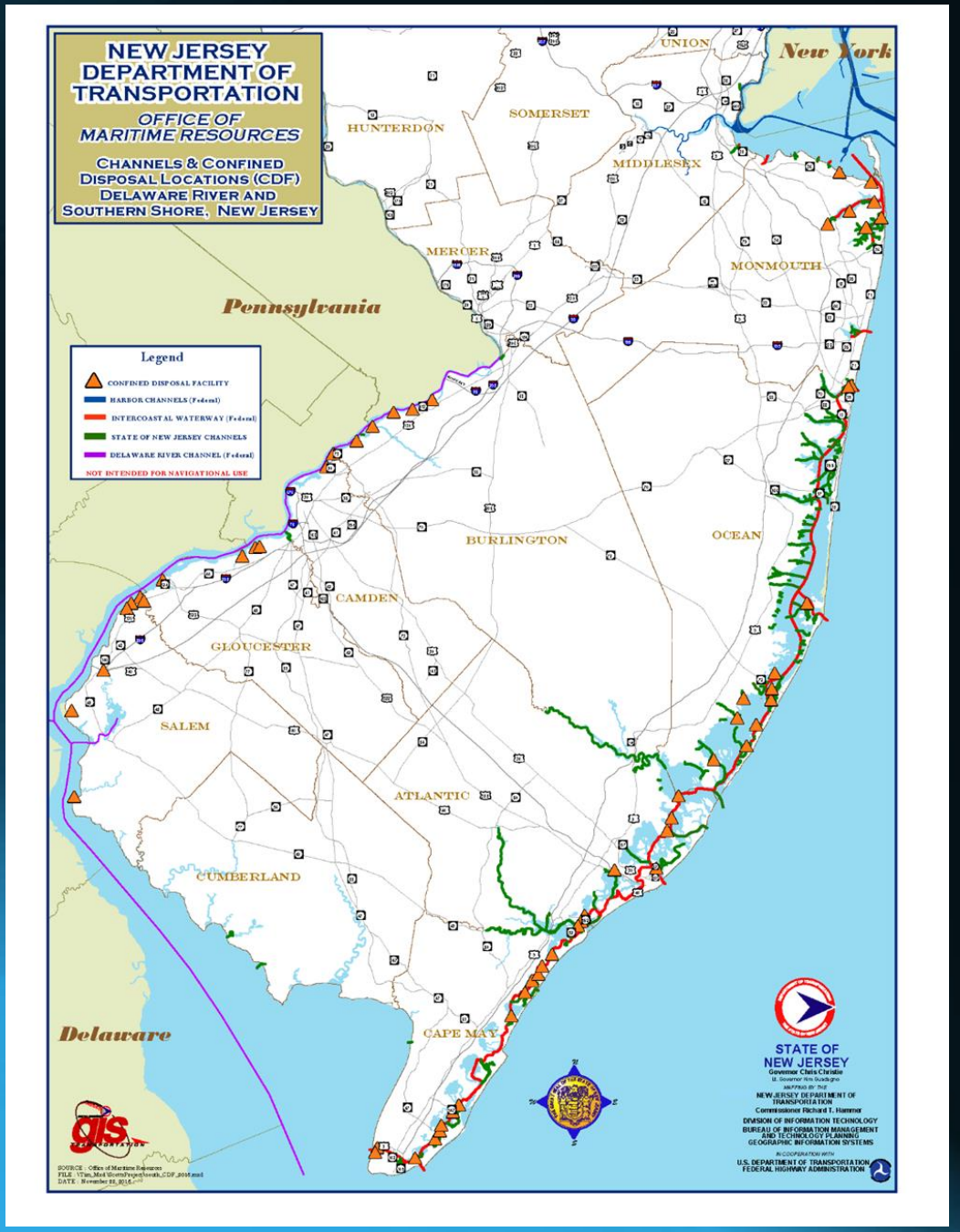
Introduction

- OMR is the lead State agency for policy and planning of maritime activities in New Jersey. OMR has been active in local, state and regional dredging and dredged material management activities for over 25 years. OMR is responsible for the operation and maintenance of the State Channel system which includes 216 channels covering some 200 nautical miles.
- Scott Douglas is the Dredging Program Manager for NJDOT/OMR and has been with OMR since its inception in 1996.
- This presentation is designed to provide you with an overview of our experiences statewide designing and implementing beneficial use projects ranging from in water capping to site remediation to marsh restoration.

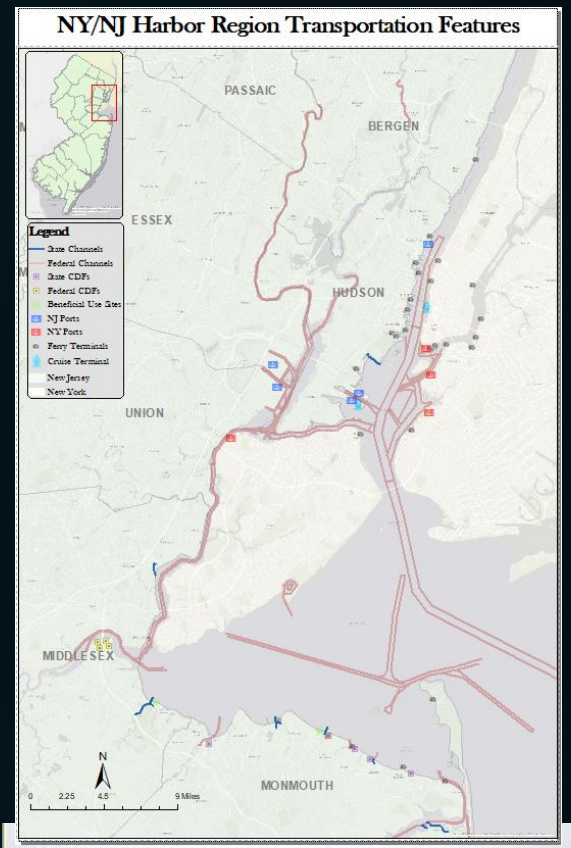
New Jersey's Marine Transportation System

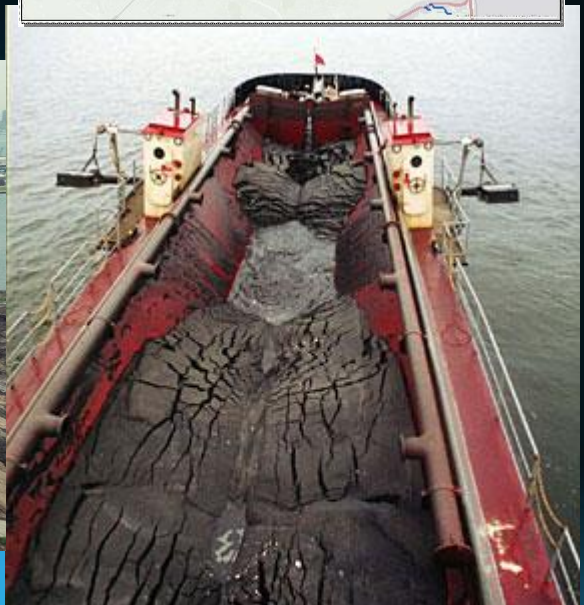
- Federal Channels in NY/NJ Harbor, Delaware River, and NJ Intracoastal Waterway; over 465 nm (860 km) of engineered waterways
- State Channel Network - 215 Marked and Identified Channels; over 200 nm (370 km) of engineered waterways
- Two International Ports (PONYNJ and South Jersey Port Corporation)
- Internationally recognized tourism destination
- World Class Fishery (most lucrative shellfishery in the U.S.)
- Worth over $50 billion annually to the New Jersey economy



NY/NJ Harbor Region

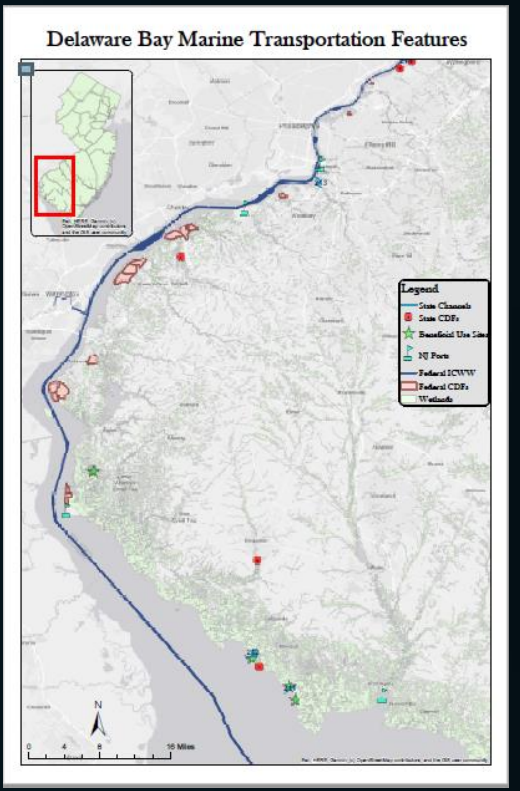
- 125 miles of waterway
- 2-4 million CY/yr
- Silty clay material
- Clamshell dredging
- Moderate to High Contamination





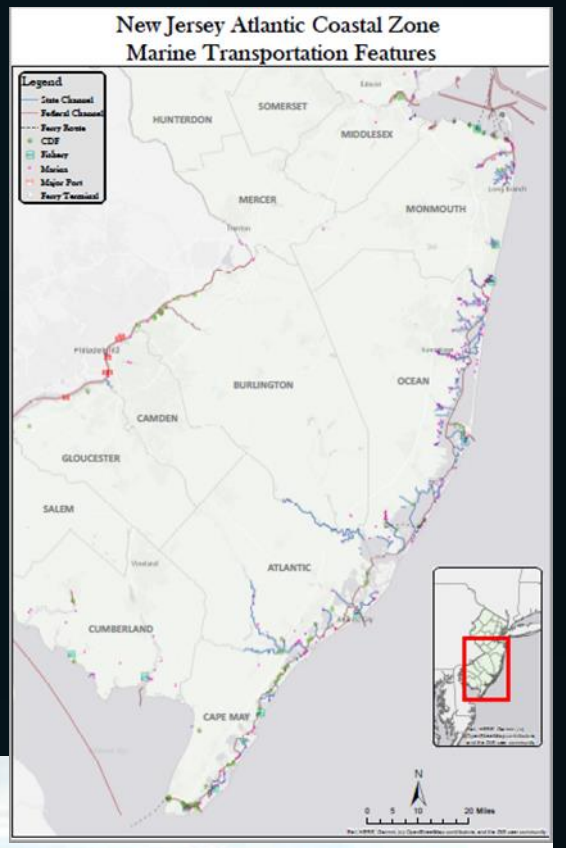
Delaware River Region

- 135 miles of waterway
- 3-5 million CY/yr
- Mixed fine sand to gravel, some silt
- Hydraulic dredging to large, Federally owned and operated CDFs
- Low to moderate contamination



Atlantic Shore Region

- 325 miles of shallow draft waterway
- 500,000 CY/yr
- Mixed from fine sand to silt
- Hydraulic dredging to CDFs
- Low contamination

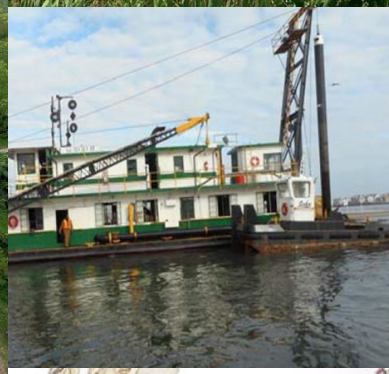


Historical Dredging Practice in New Jersey

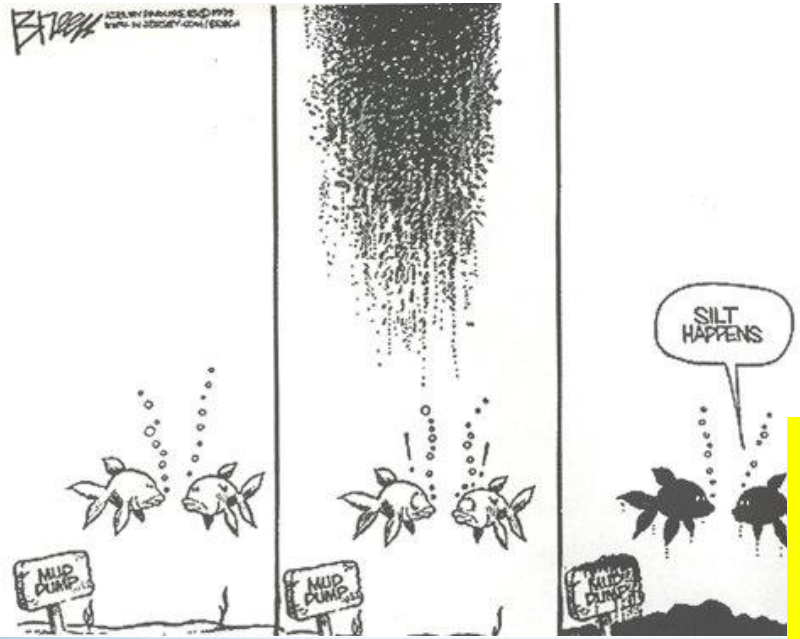
- Mechanical dredging to Ocean Disposal (NY/NJ Harbor)
- Hydraulic pipeline dredging to upland confined disposal facilities (Atlantic coast and Delaware River)
- Little if any beneficial use (other than beach replenishment prior to 1990)
- No formal coordination between regions

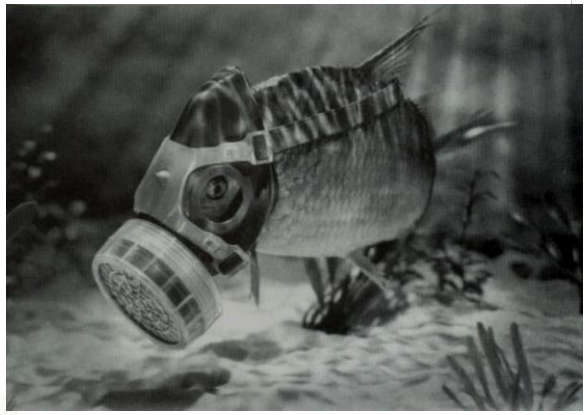




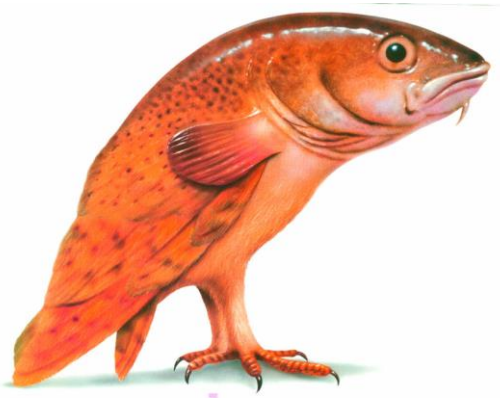


1992 - Mudlock





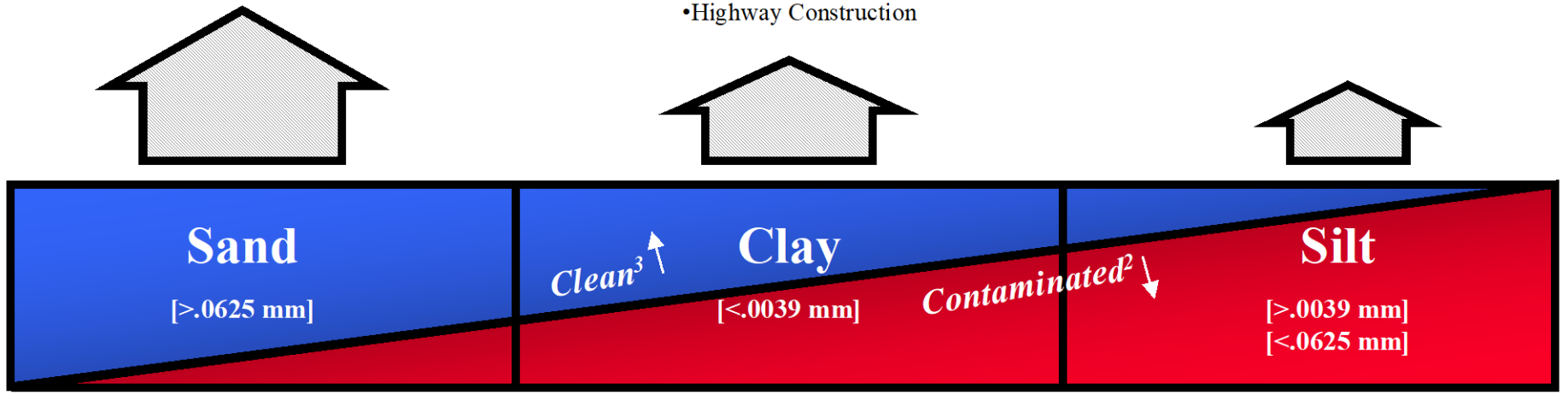
New Jersey Paddle Protest January 2000



Regional Dredged Materials Management Plan (DMMP)

- Reduce Need to Dredge
- Reduce Contamination
- Beneficially use as much as possible
- Dispose of only what cannot be used

What Happens to Our Dredged Material?



- Manufactured Soil
- Aggregate
- Intermediate Landfill Cover
- Ocean Disposal
- Beach Nourishment[1]
- Habitat Restoration/Creation
- Upland Fill
- Highway Construction

- Intermediate Landfill Cover
- Confined Aquatic Disposal
- Confined Upland Disposal
- Upland Fill
- Nearshore Fill (with Capping)

- Manufactured Soil
- Ocean Disposal
- Landfill Final Cap
- Landfill Liner
- Upland Fill
- Nearshore Fill
- Brownfield Cover
- Habitat Restoration/Creation
- Highway Construction

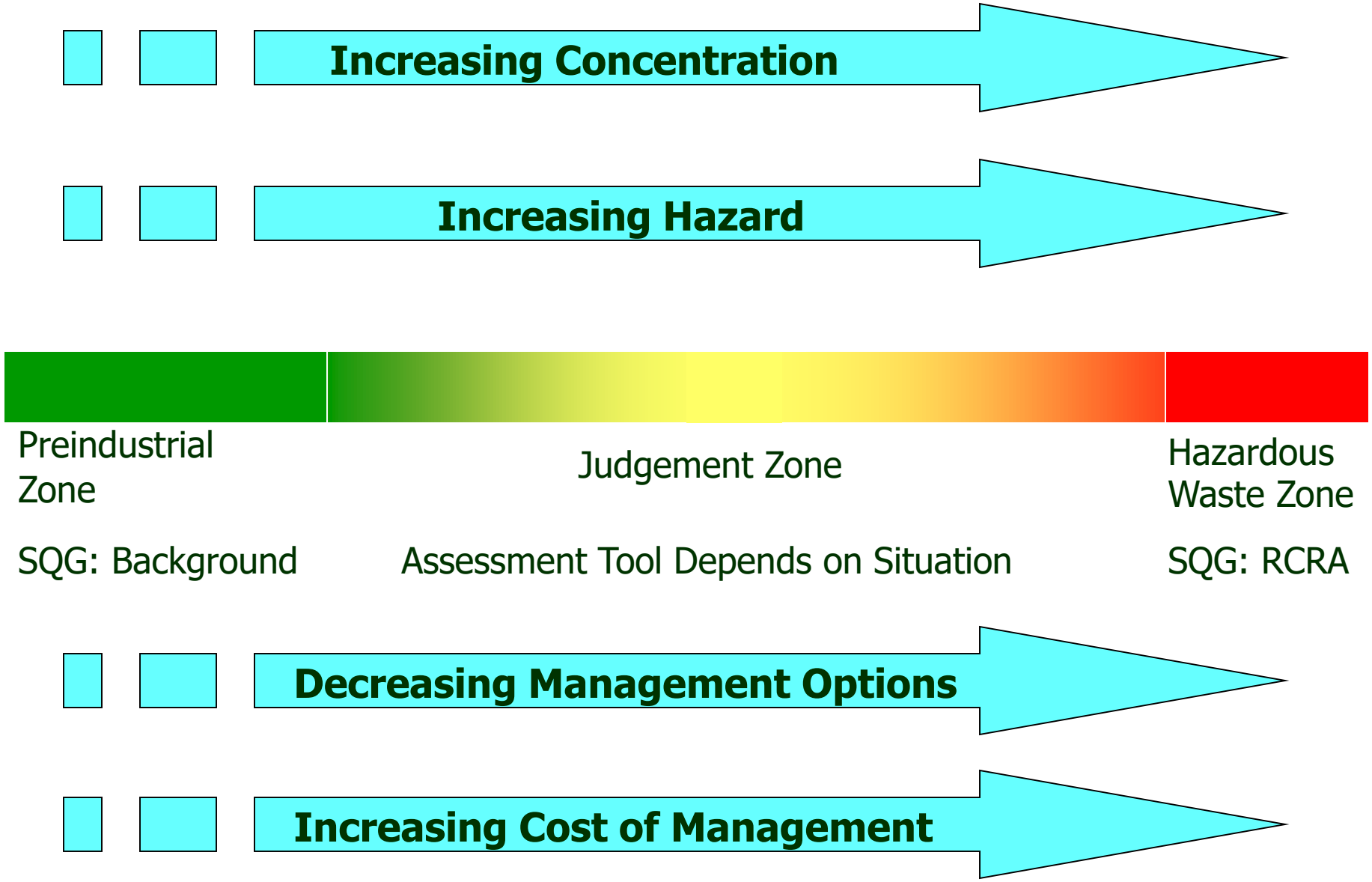
- Confined Aquatic Disposal
- Confined Upland Disposal
- Nearshore Fill (with Capping)
- Landfill Cap (with Clean Cover)
- Brownfield Cap (with Clean Cover)
- Mine Reclamation

- Upland Fill
- Brownfield Cover
- Habitat Restoration/Creation
- Nearshore Fill
- Manufactured Soil
- Highway Construction

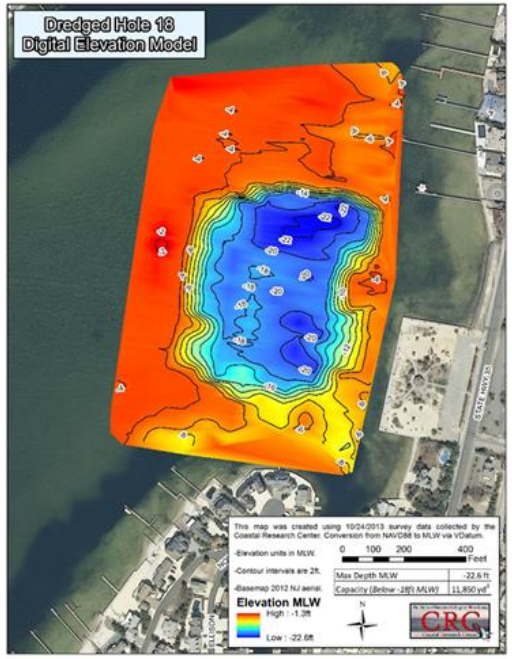
- Confined Aquatic Disposal
- Confined Upland Disposal
- Nearshore Fill (with Capping)
- Landfill Intermediate Cover
- Mine Reclamation
- Brownfield Cap (with Clean Cover)
- Decontamination and Disposal

[1] 75% Sand; grainsize distribution must be equivalent to existing conditions
[2] Uses assume no decontamination
[3] Uses assume clean or decontaminated

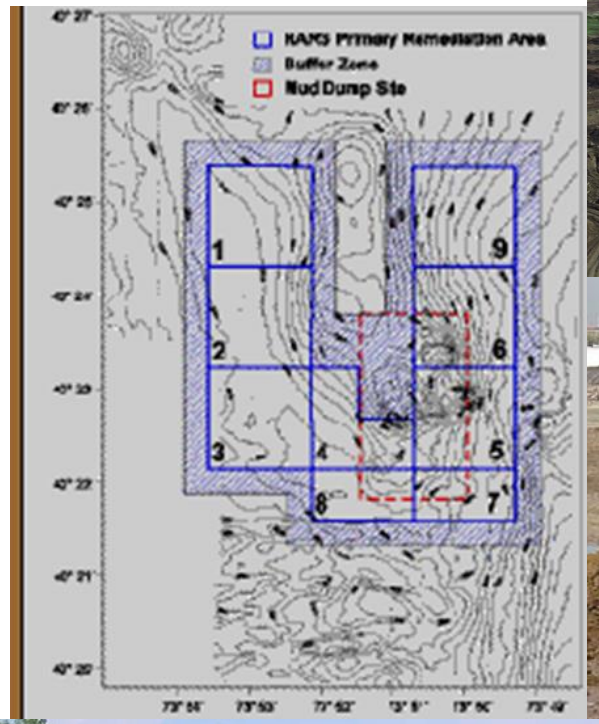
Sediment Management Decision Making



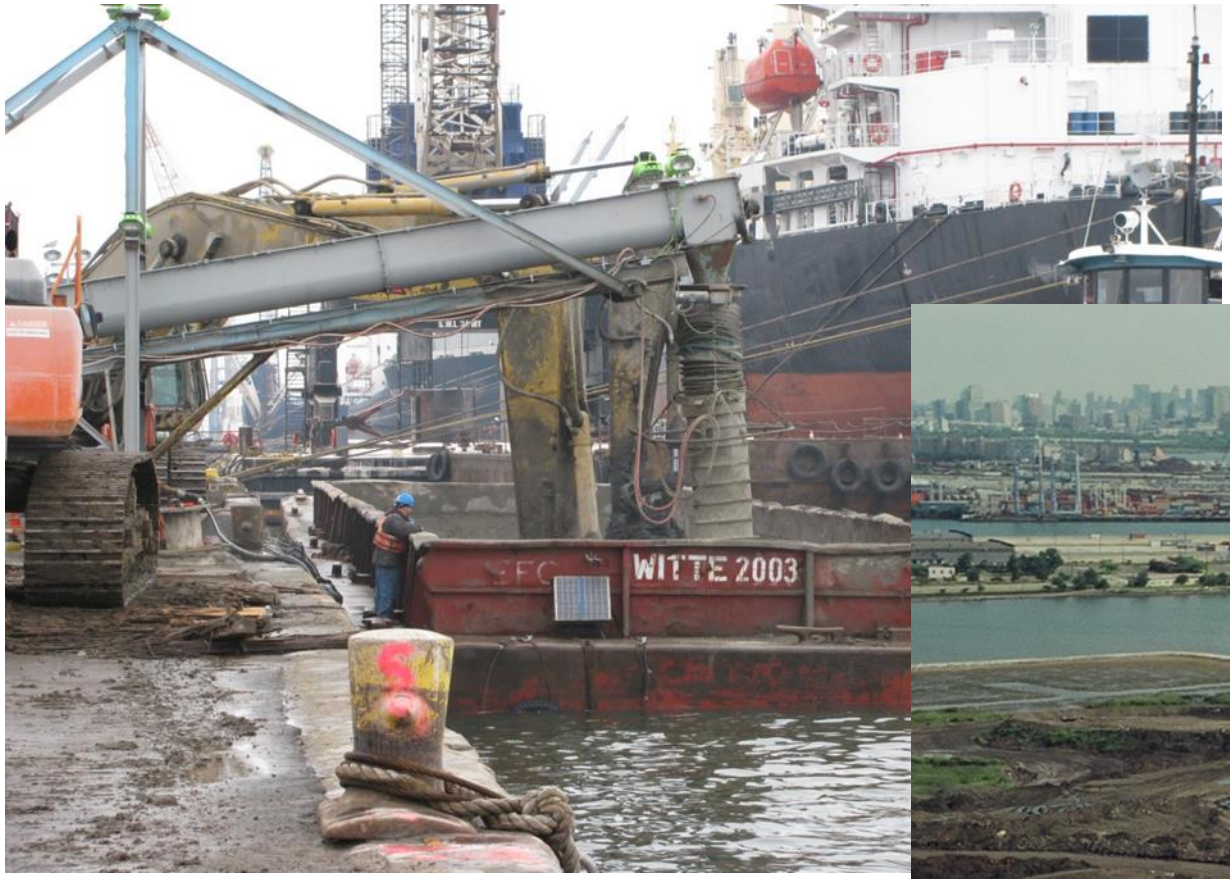
Beneficial Use in New Jersey

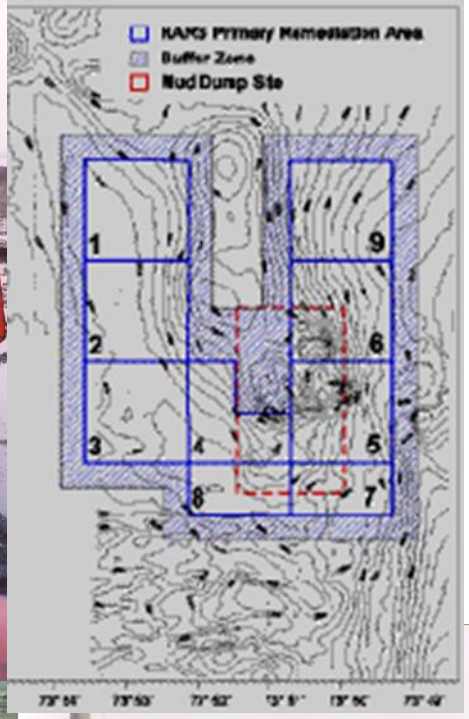


- Beach Replenishment
  - Bathing beaches
  - Wildlife beaches
- Construction Aggregate
  - Sand
  - Rock
  - Non-structural Fill
- Site Remediation
  - Brownfields
  - Landfills
  - Abandoned Mines
  - Mud Dump
- Habitat Restoration
  - Upland
  - Aquatic



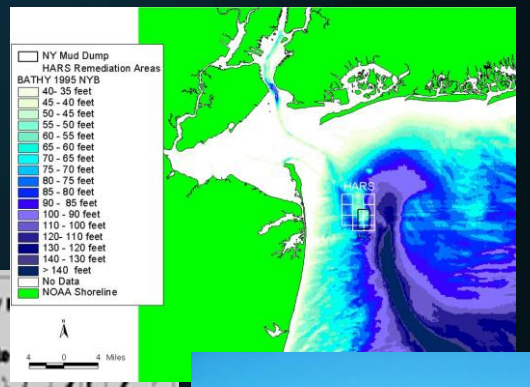
Beneficial Use in NY/NJ Harbor





Habitat Enhancement

- Tens of millions of CY of clean sand, clay, rock and glacial till have been used for habitat enhancement and remediation projects



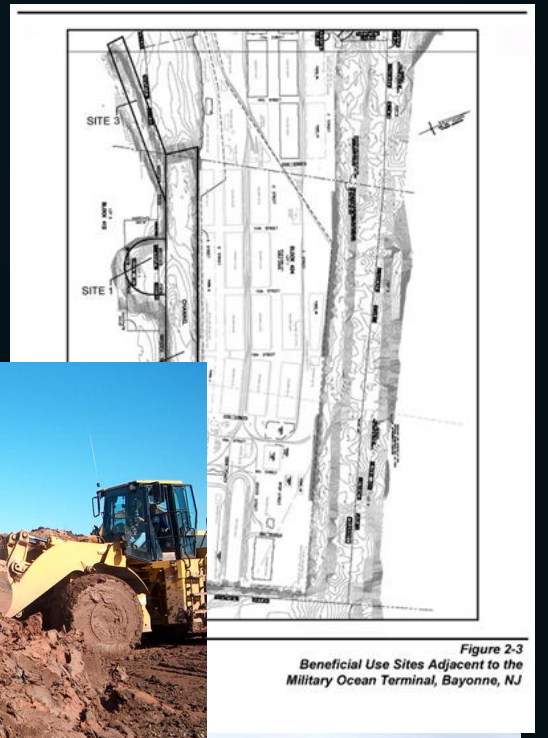
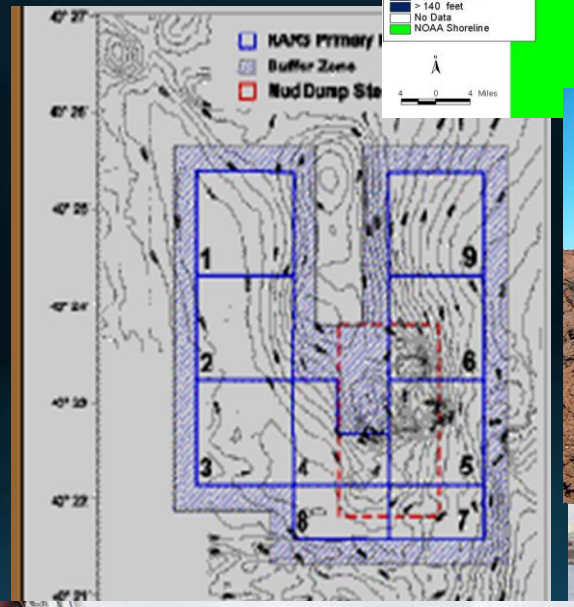
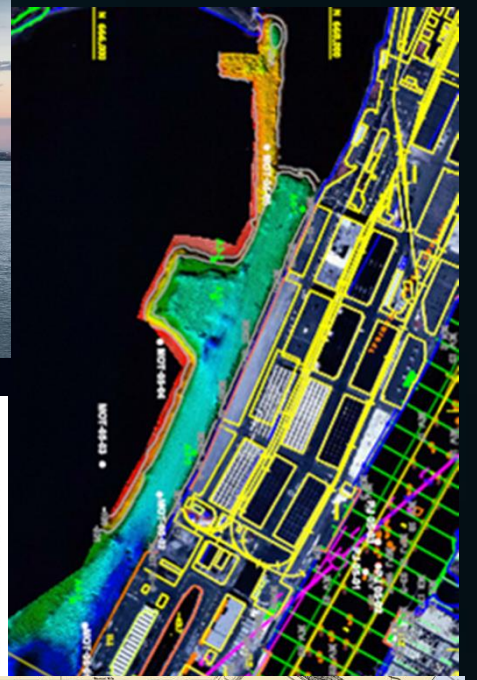


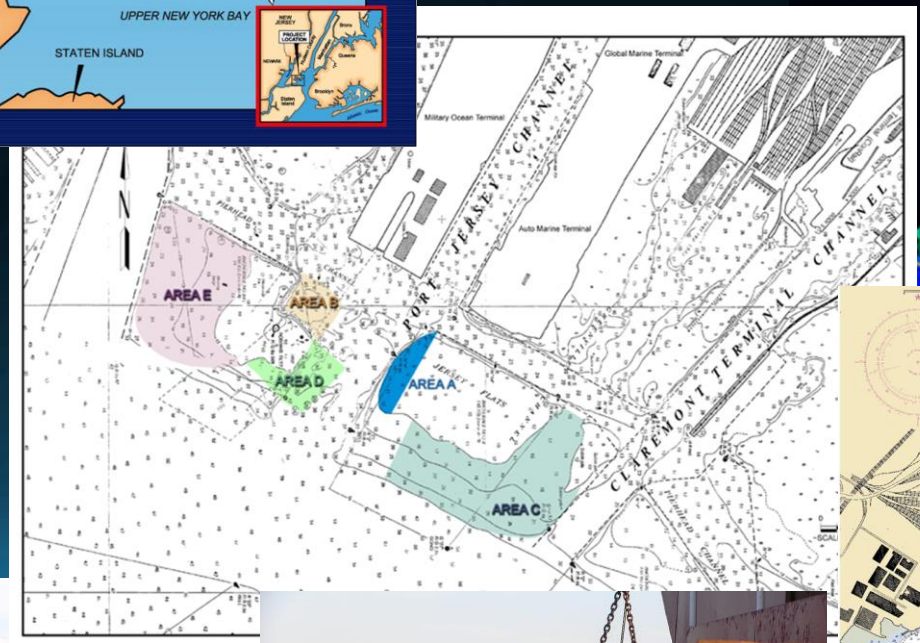
Figure 2-3
Beneficial Use Sites Adjacent to the Military Ocean Terminal, Bayonne, NJ

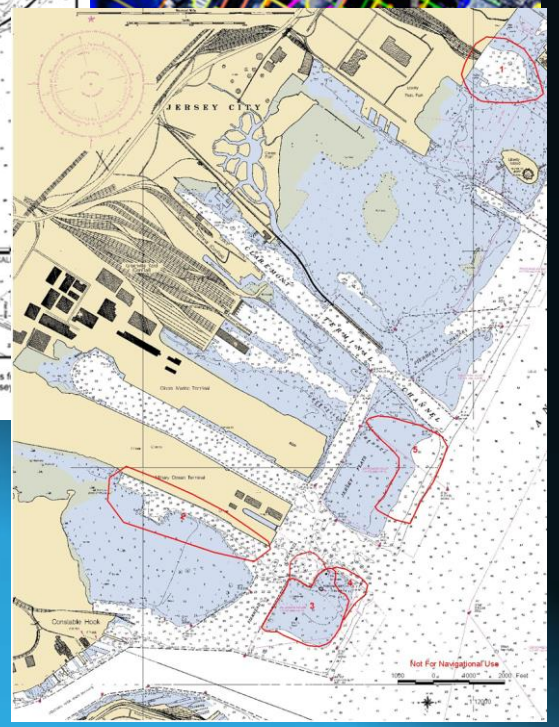


Case Study 1: Port Jersey

- Mitigation needed for removal of 12.5 acres of Port Jersey Flats
- Abandoned berthing channel for MOTBY
- 35 ft deep surrounded by shallow water habitat
- Anoxic fluid mud bottom sediment
- 953,000 CY placed using split hull scows
- $21 per cubic yard
- 38 acres of habitat created

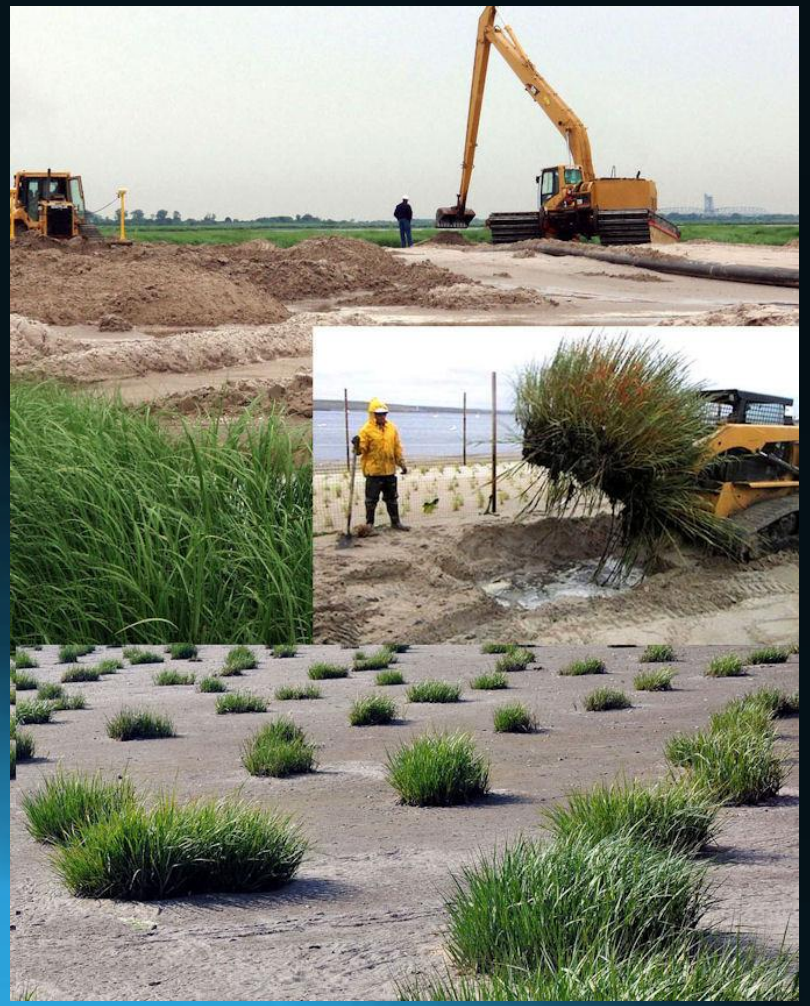






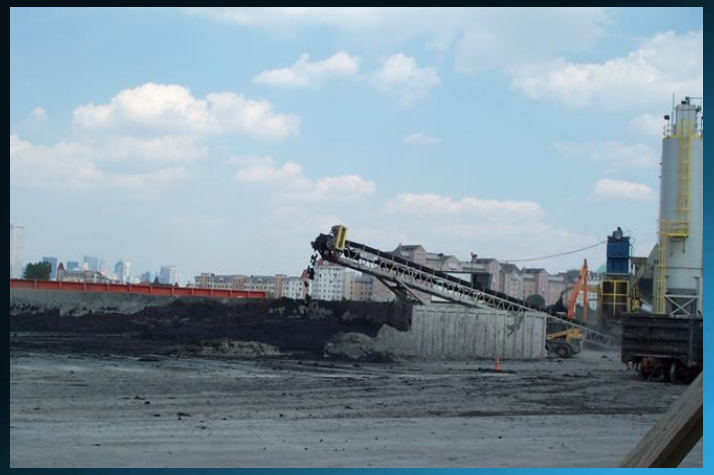
Case Study 2: Jamaica Bay Islands

- Direct placement with hydraulic cutterhead pipeline dredge
- 5 Islands being lost to SLR restored (155 acres)
- 1.2 MCY clean sand from Harbor Deepening
- Plugs from other islands used to "plant" the new DM
- Cost: $14-21/CY



Site Remediation

- Landfills, Brownfields, Abandoned Mines
- Sediment amended with Portland Cement an/or other pozzolans
- Material used as cap or grading fill
- Scalable; tens of millions of cubic yards and hundreds of acres restored/remediated
- Habitat, parks or commercial redevelopment
- Cost varies greatly depending on distance of site from dredging and commodity price of pozzolanic additives. Typically $50-80 per cubic yard.



*Upland Beneficial Use of Processed Dredged Material since 1997**

- Landfill Closure: 12 million CY
- Brownfield Remediation: 23 million CY
- Construction Fill: 1.7 million CY
- Abandoned Mines: 20 million CY
- Total: 56.7 million CY
- Acres restored/remediated: >300
- Cost: 60-80/CY

* Volumes represent both placed and available capacity

Case Study 3: OENJ Elizabeth

- Mechanical Dredging into open scows followed by in-barge processing
- DM was mixed with various admixtures such as Portland cement, LKD, CKD and fly ash
- Approximately 800,000 cy of PDM was placed in 12-inch layers and compacted to 88-92 percent of maximum dry density
- Jersey Gardens Mall and parking lots restored tax base
- Capping and leachate collection installed on entire site
- 2 restored wetlands (14 acres)
- Cost of $22 million

Abanonded Mines and Quarries

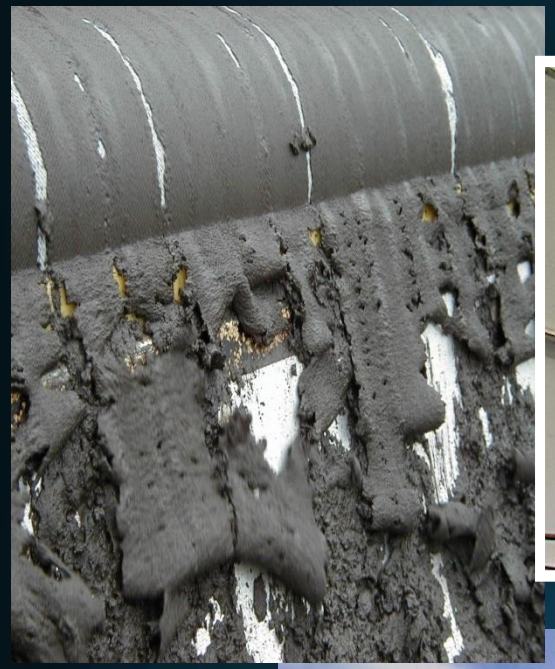
- Abandoned coal mines and quarries throughout eastern PA represent hundreds of millions of cubic yards of potential capacity for placement of dredged material
- Many of these sites leach contamination into surrounding waterways

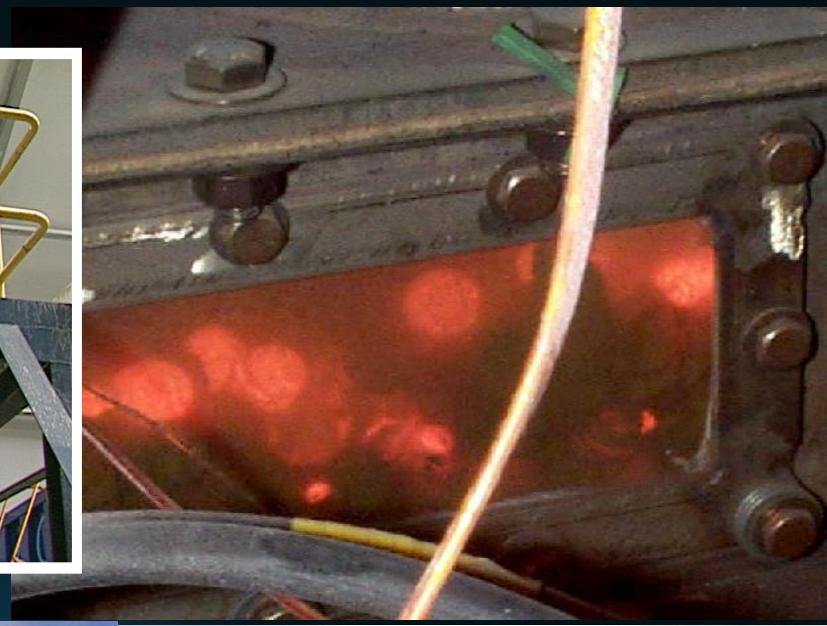
Case Study 4: Bark Camp Mine

- Mechanical dredging into open scows followed by pugmill processing
- DM mixed initially mixed with Portland Cement
- Transported via rail to mine site
- Final dewatering/amendment with ash mixture in PA
- Final cover and planting
- 425,000 CY at a cost of $45 – not including dredging.

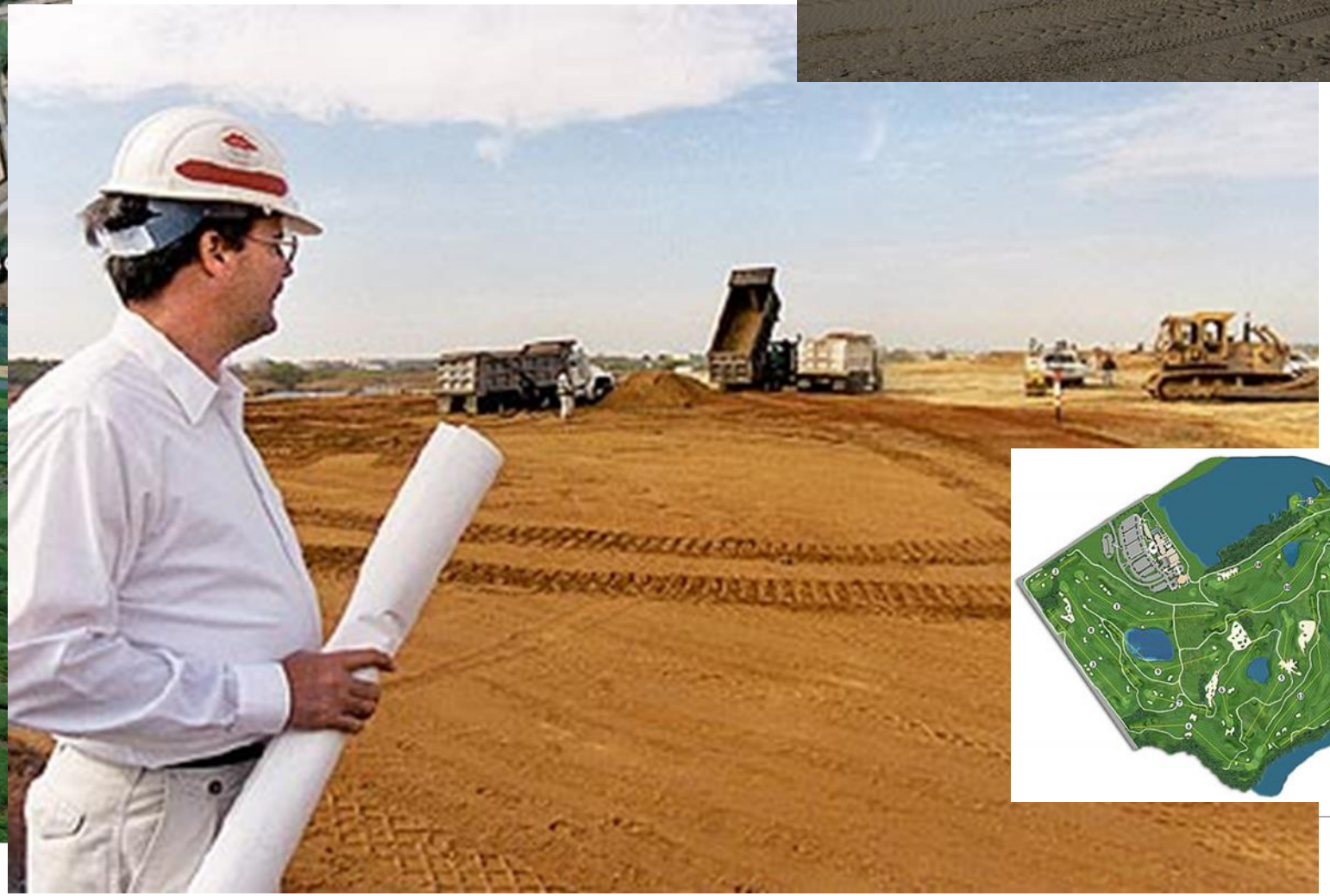
Environmental Manufacturing (decon)

- EPA/NJDOT sediment decontamination technology demonstration program
- Thermal desorption
- Sediment washing
- Chemical destruction
- Enhanced geoamendments
- Theoretically unlimited capacity
- Cost and capitalization



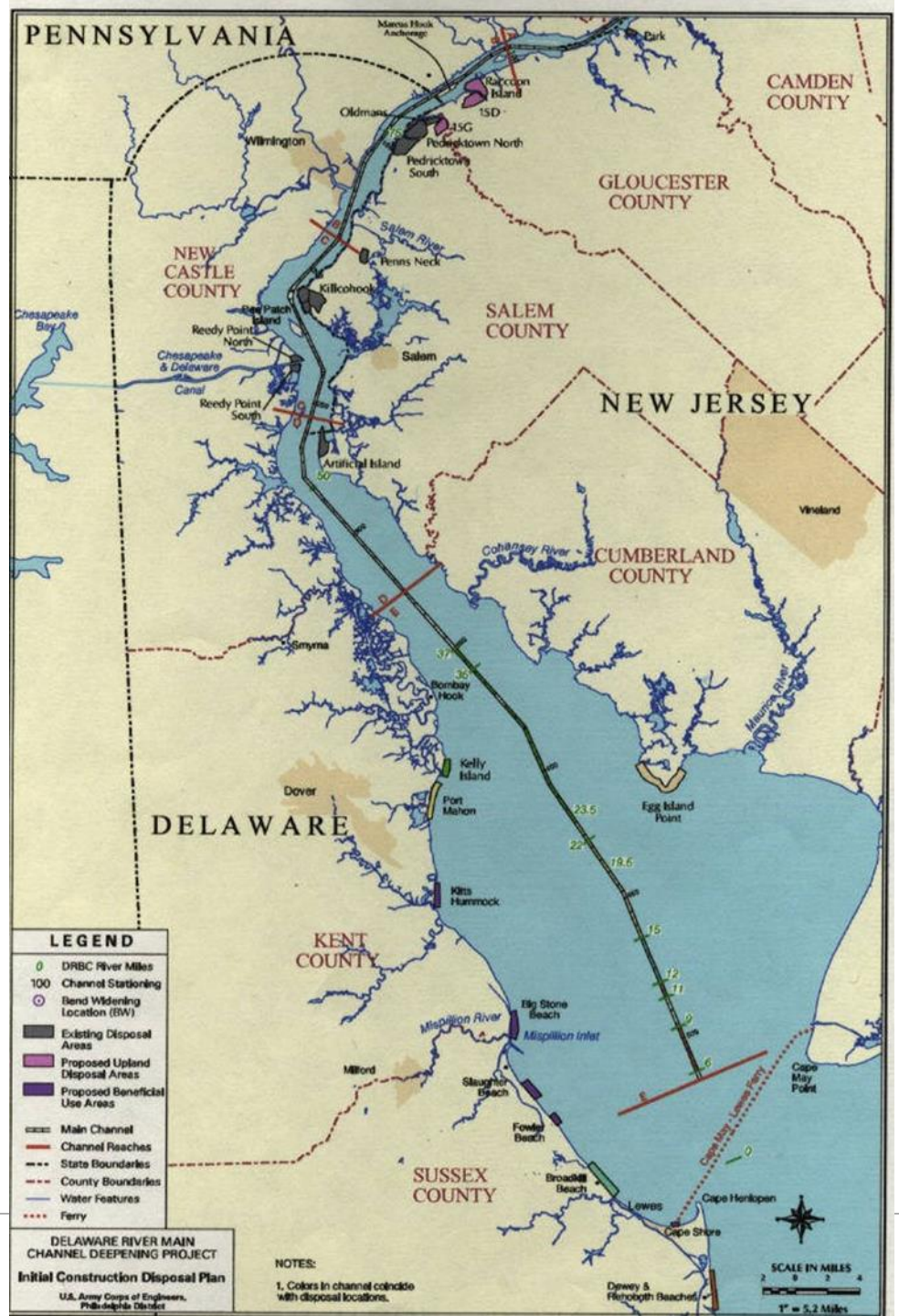


Beneficial Use in the Delaware River



Delaware Deepening

- 26 million cyd
- Mostly sand and sandy silt
- 229,000 cyd rock; 77,000 cyd requires blasting
- 18.3 mcy to be placed in upland CDFs
- 7.2 million cyd clean Bay sand to be beneficially used
- Maintenance requirements 6 million cyd/yr (up from 4.9 mcy/yr)



Beneficial Use of CDF Material

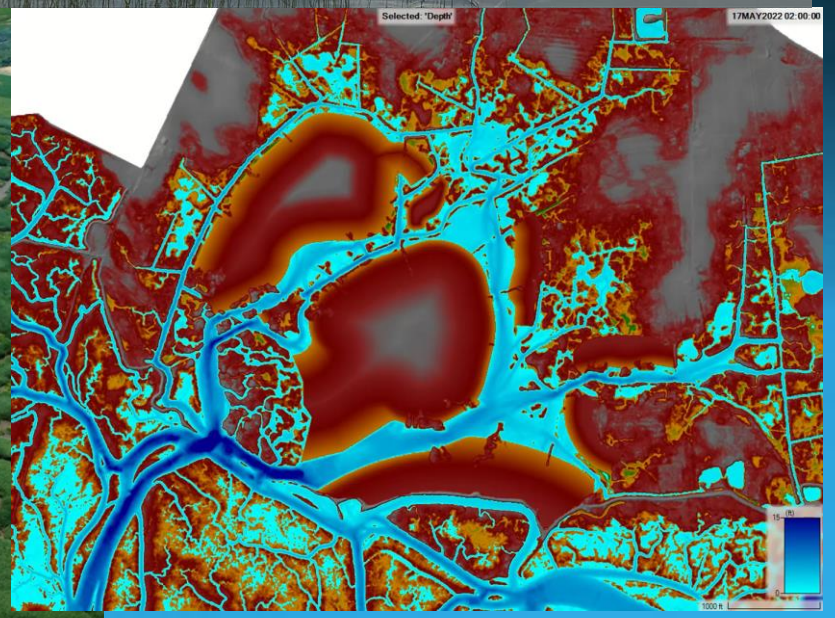
Delaware River Beneficial Use of CDF Material

- GROWS Landfill – 150,000
- Tamaqua Mine – 550,000
- Burlington County RCC – 15,000
- Tweeter Center – 220,000
- Riverwinds Golf Course – 160,000
- New Jersey Turnpike-180,000
- Philadelphia Airport – 1,900,000
- Dream Park – 800,000
- Reedy Point – 200,000
- TacPal Redevelopment – 400,000
- **Total to date: 4,575,000 CY**

Case Study 5: Cinnaminson/Palmyra

- Reconstruction/renewal of two existing CDFs
- Excavation and removal of 200,000 CY from each CDF, for a total of 400,000 CY of mostly coarse-grained material
- Material beneficially used to cap and grade 100-acre TacPal Redevelopment site (abandoned landfill)
- Remaining on site material used to shape berms for next use
- Creation of 350,000 CY of capacity

Case Study 6: Abbotts Meadow (planned 2023)



- Former salt hay farm with partial impoundment, mostly open water and uplands with Phragmites and other invasives
- Hydraulic cutterhead pipeline dredge
- >5 miles of pipeline
- 603,000 CY mixed silty sand from NJ Wind Port
- 365 acres of high and low marsh will be restored

Beneficial Use in the Atlantic Coastal Zone

2012 – Superstorm Sandy

- 300 miles of waterway
- 3 million CY of sediment
- Significant portions of system without viable dm management capacity
- FEMA supported until 2024 up to $61 million

Dredged Material Management Facilities

- Renewable Capacity
- Manage material inputs and outputs to increase options, decrease dewatering time and lower costs
- Permanent access roads or docking facilities; staging areas; pipelines
- Regional Sediment Management

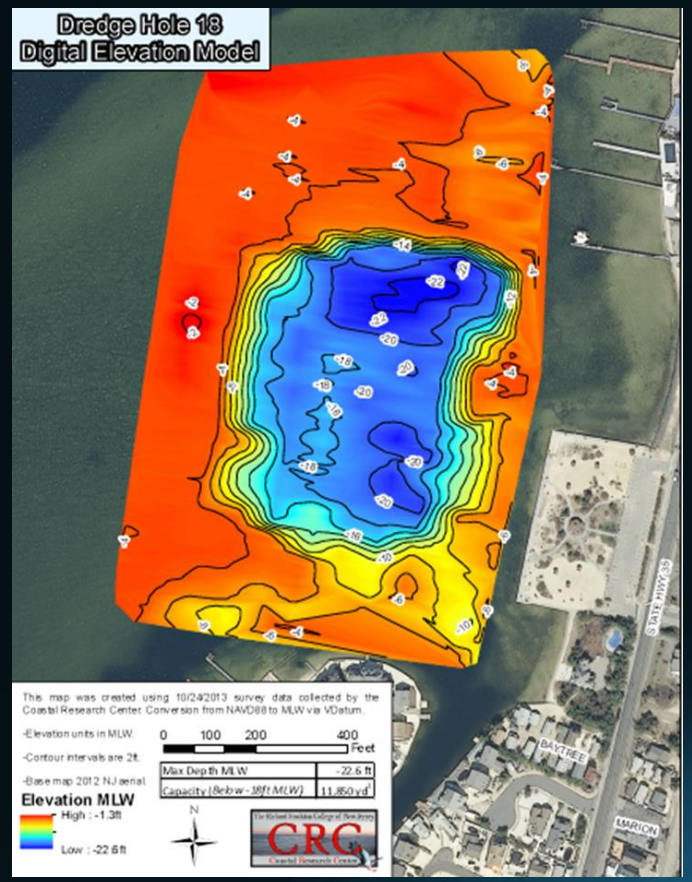
Upland Beneficial Use

- Mechanical (belt filter press)or Passive (geotubes) dewatering
- Daily cover at landfills
- General construction fill
- Blended engineered fill
- Agricultural supplement
- Raising CDF berms
- Resiliency projects

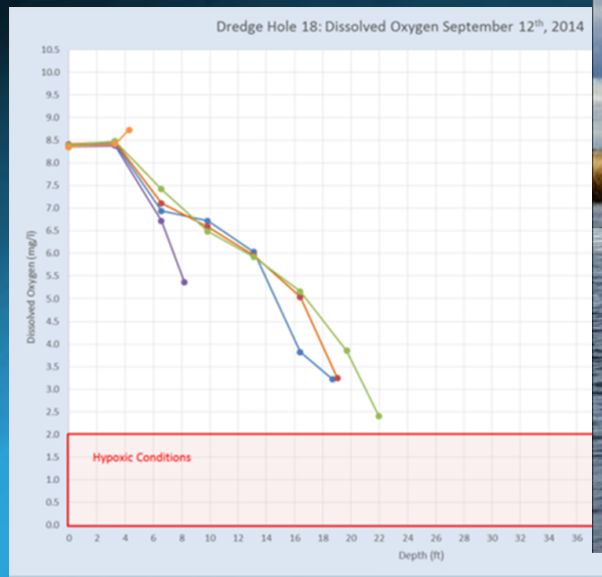
Case Study 7: Shark River

- Hydraulic dredging into geotubes or mechanical filter press/hydrocyclone
- 68,500 CY over 205 days; three seasons
- Two processing sites due to scheduling conflicts
- Daily cover and beach fill
- Regular discharge monitoring for turbidity and TMDL chemicals (PCBs, metals, pesticides)
- $105 per CY

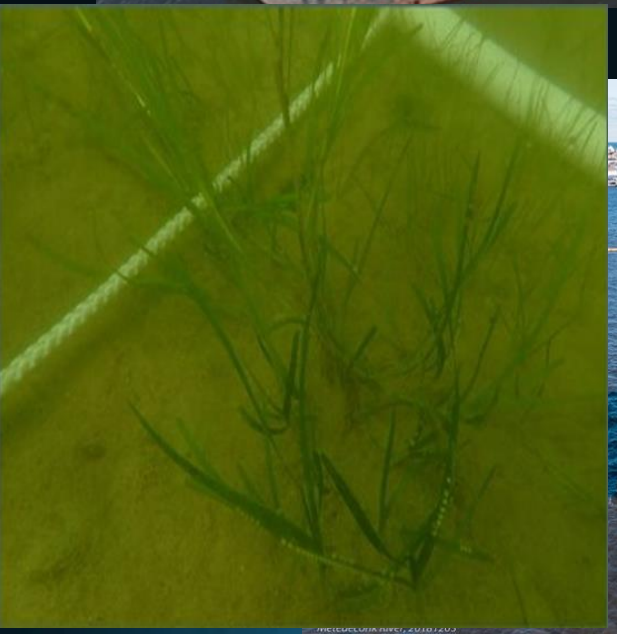
Benthic Restoration



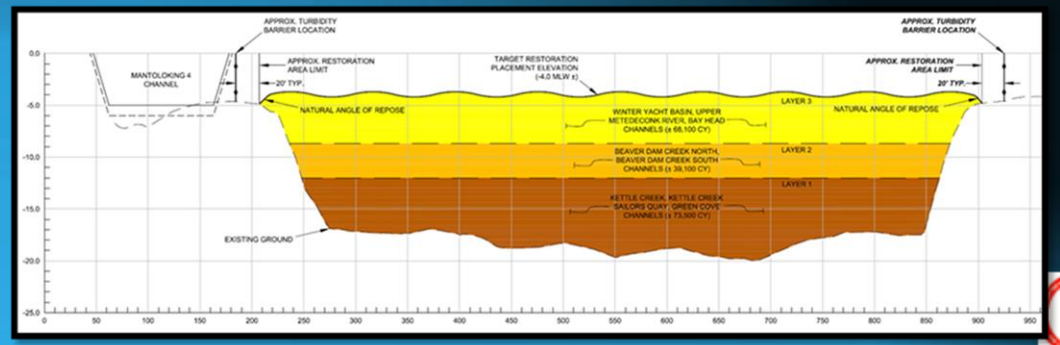
- Dredged Holes
- Eroded Mudflats
- Water Quality Improvement
- Mitigation
- Hydraulic or mechanical placement
- Large and small volume projects, easily scalable
- Extensive up front evaluation and monitoring during and after construction
- $60-70/cyd



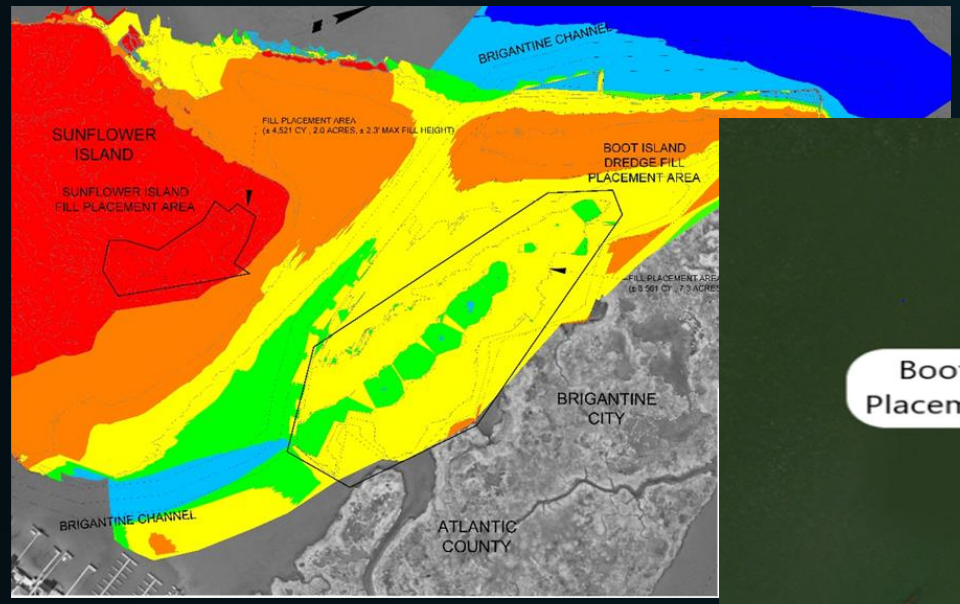
Case Study 8: Dredged Hole 18

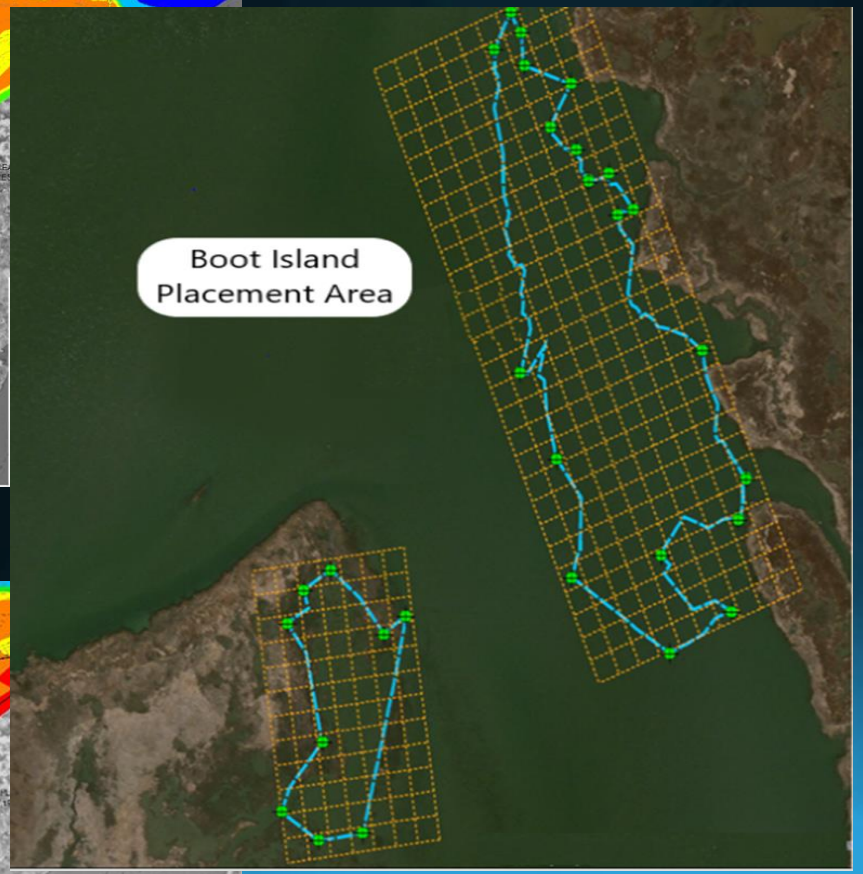


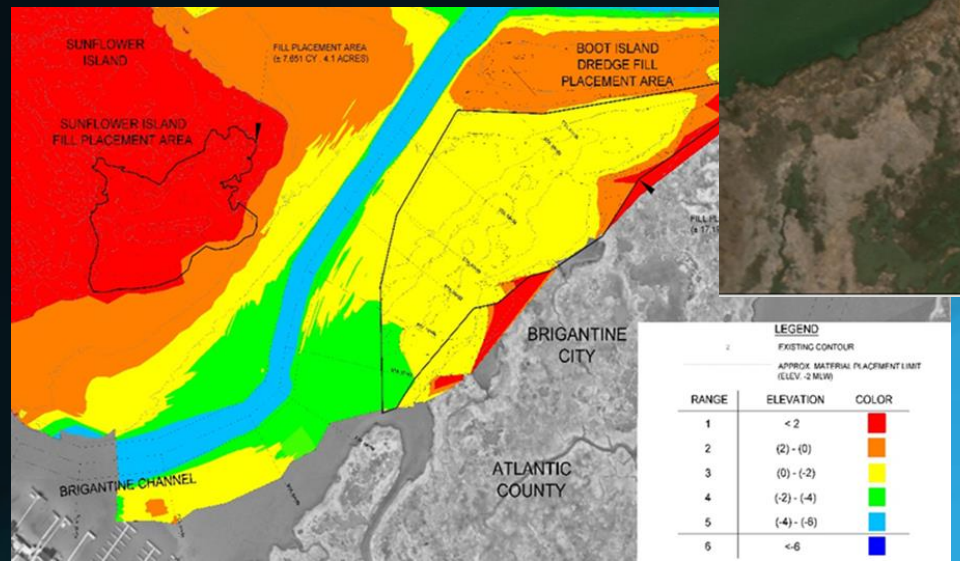
- Beneficial Use Type: benthic restoration
- Placement Technique: mechanical
- Dredged Material Placed: 244,100 CY
- Project Cost: $19,065,195
- Cost per cubic yard: $78
- Acres Restored/Enhanced: 9 acres
- Cost/acre: $2,118,355
- Lesson Learned: Wind events caused more turbidity than placement technique



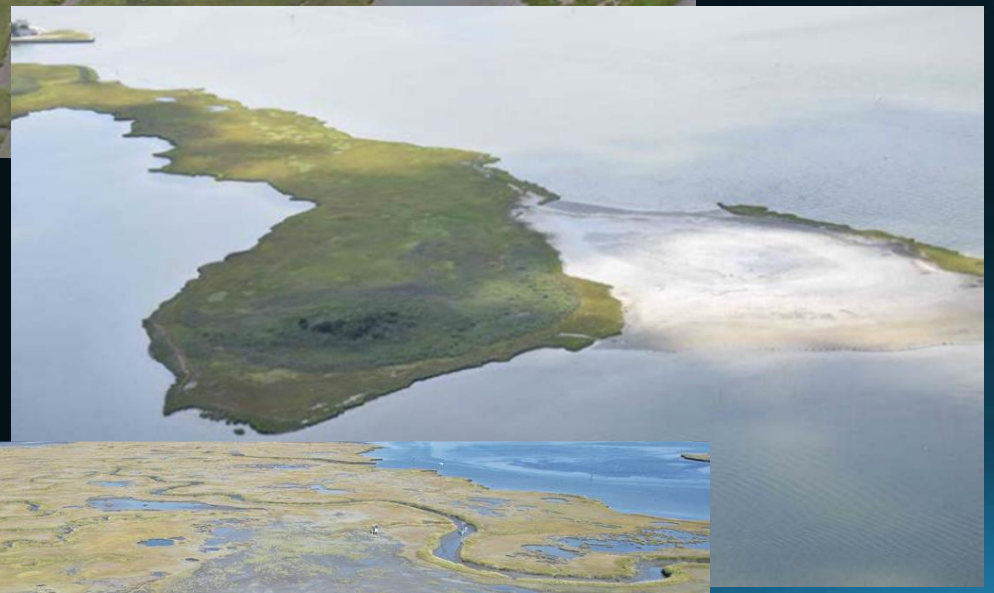
Case Study 9: Brigantine

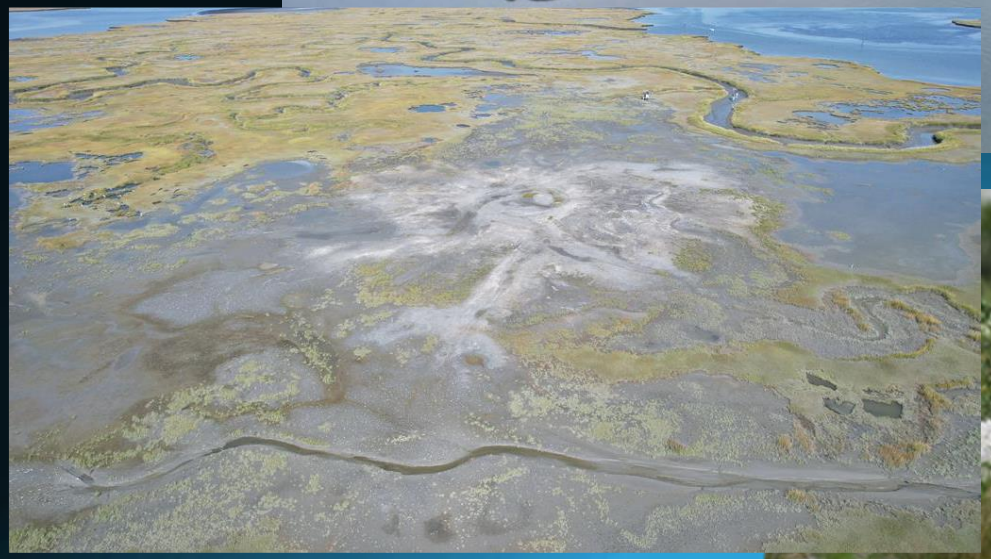






- Hydraulic cutterhead pipeline dredging with direct in water placement over 21 days
- Boot and Sunflower Islands
- 24,843 CY at $59/CY
- 23.6 acres of shallow water habitat created
- 500 ft of shoreline stabilized





Habitat Creation

- Clean dredged material only
- Usually sand, but other material types could be used
- Refugia from humans and predators in high use areas
- Highly successful
- Repeated applications possible
- Technically easy to scale up, but permitting may become an issue
- $30-$60/cyd

Climate Change Impacts in New Jersey

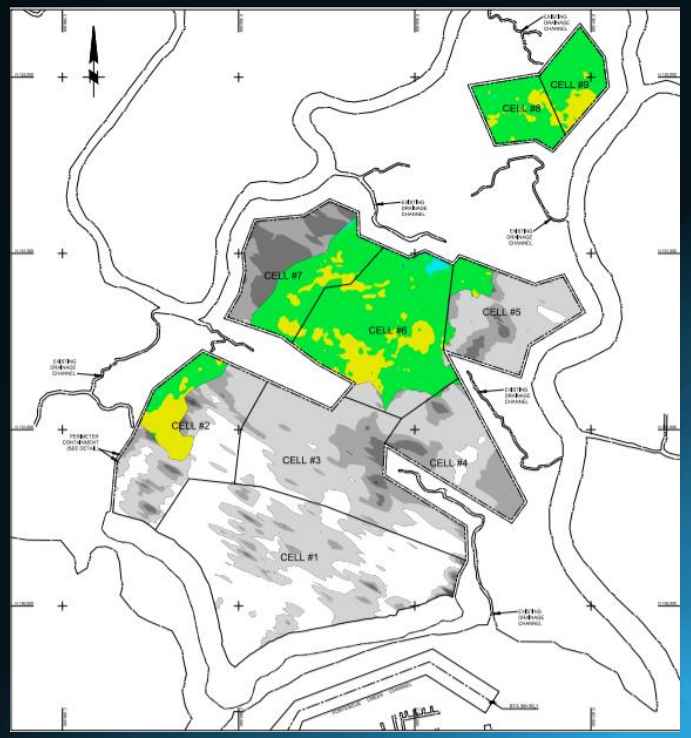
- Sea Level Rise
- Storm Surge
- Infrastructure Damage
- Shoreline Erosion
- Marsh Platform Loss
- Over 59,000 acres of marsh already lost, another 75,000 acres threatened
- Cost of Superstorm Sandy: $37 Billion

Marsh and Dune Restoration

- Coastal erosion and sea level rise has taken a toll on NJ coastal wetlands
- Dredging has further reduced natural accretion
- Dredged material can be used to return sediment to the marsh, stabilizing and/or raising the platform and improving habitat
- Dunes can provide resiliency for restored marsh
- Need to identify marshes at risk and establish expectations
- $65-105/cy

Case Study 10: Fortescue

- 37,139 CY of material hydraulically placed upland
- 41 days of dredging over two seasons
- 8,529 CY; 6.6 acres of marsh enhanced
- 7,565 CY; 1.6 acres of beach replenished
- 21,045 CY; 1100 linear ft of dune created
- $88 per CY



Shoreline Stabilization

- SLR and storm events have increased erosion on marsh edges throughout the State
- The 1977 NJ Tidelands claim line
- Hardened vs. natural shoreline
- Direct vs. indirect placement
- $75-100 per cubic yard

Case Study 11: Good Luck Point

- Direct nearshore hydraulic placement of sand in open water
- 6,000 CY sand
- 11 days
- 1700 linear feet of beach enhanced
- $76 per CY (excludes mobilization)

Lessons Learned in New Jersey

- **Define Success Criteria** Up Front – be realistic!
- **Avoid Over-engineering**
- **Hire Experienced Contractors** and Listen!
- **Have an Adaptive Management Plan** for before, during and after construction
- **Define Multiple Sources/types of Material** and **Multiple Placement Sites** to reduce risk
- **Minimize Use of Heavy Equipment**
- Be prepared, be flexible, be patient!

Patience Pays

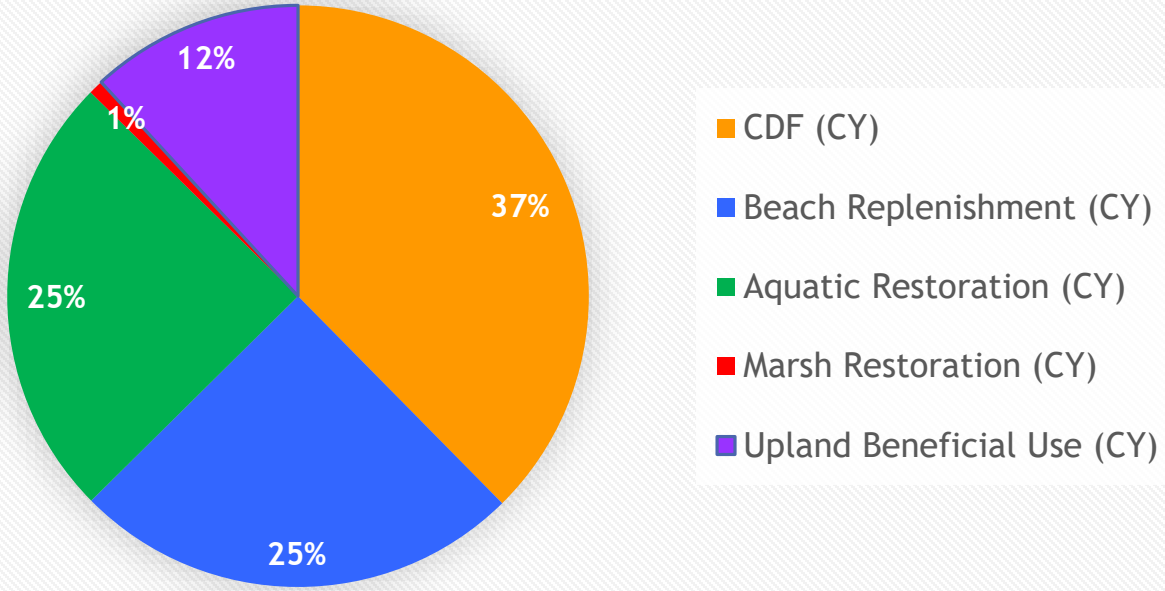
Dredging and Dredged Material Management since Superstorm Sandy

1.9 Million CY

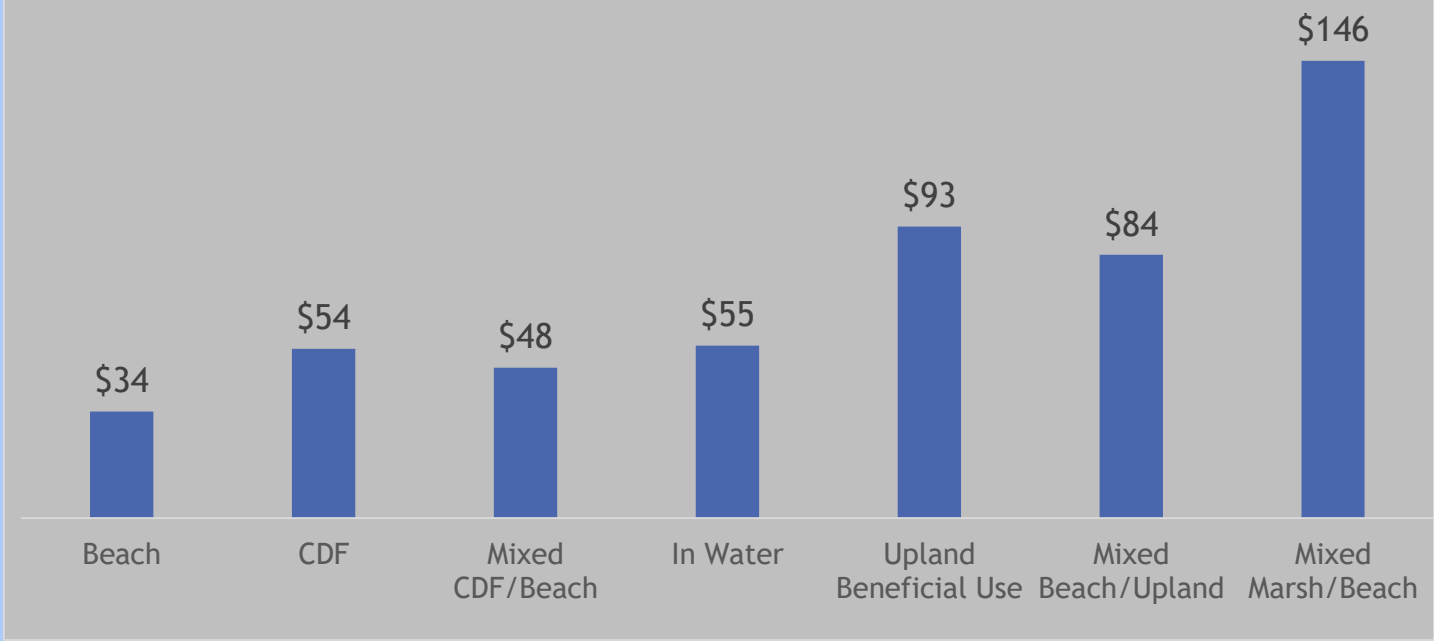
$120 Million

>60% Beneficial Use

SCDP Managment of Dredged Material



Average Construction Cost per CY



Ongoing Challenges

- Site selection and approval
- Permitting
- Cost (2-3 times more expensive)
- Schedule (can be much slower)
- Hiring experienced contractors
- Achieving economy of scale
- Reducing risk
- Repeatability and Predictability
- Monitoring (pre, during and post-construction)
- Adaptive Management
- Restoration goals v. performance standards
- Managing expectations

Programmatic Beneficial Use Considerations

Dredging Questions

- How will the material be dredged?
  - Hydraulic or mechanical
  - Size of dredge
- How much material will be dredged?
- Can multiple locations for dmm be used?
- When will it be dredged and over what time period?
- What are the characteristics of the material?
  - Grain size
  - TOC
  - Chemistry
- Are there any timing restrictions?
- Is this a "least cost environmentally acceptable alternative"?
- If not, who is going to pay the increased cost?

Restoration Questions

- Where are the sites you want to restore?
- What type of restoration/remediation is envisioned?
- Has there been "buy in" on the need for restoration?
- What are the restoration goals?
- How much of what types of material does the site need?
- How fast can the site accept material?
- Are there options for placement if things go sideways?
- Adaptive Management
  - During Project (who does what, who pays?)
  - After Project (who does what, who pays?)
- Long term Monitoring

Programmatic Cost/Benefit Considerations

Shared Assets
Shared Responsibilities
Shared Benefits

Costs

- Engineering/Permitting
- Construction
- Site Evaluation
- Adaptive Management
- Long term monitoring

Benefits

- Improved navigation
- Increased storm resiliency
- Restored/improved/protected habitat
- Avoided storm damage
- Remediated property for development





Programmatic Lessons Learned

- Articulate a beneficial use policy from the top down.
- Clear a regulatory pathway to implementation
- Understand the cost/benefit picture and be willing to cross programs
- Understand what all stakeholders want/need and write it down!
- Establish Regional Dredging Teams and meet regularly

Questions?

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